

IN THE CLAIMS:

The following is a complete listing of the claims, and replaces all earlier listings and all earlier versions.

1. (Currently Amended) An image processing apparatus for performing a dynamic range compression processing to an arbitrary image to add a high frequency component obtained based on the image, the image processing apparatus comprising:

gradation conversion means for performing gradation conversion on the image based on a gradation conversion curve;

storage means for storing information concerning the gradation conversion curve;

conversion means for converting the a magnitude of the an amplitude of said-added the high frequency component based on information concerning the magnitude of the high frequency component and the information concerning the gradation conversion curve; and

control means for controlling said gradation conversion means and said conversion means,

wherein said control means controls to perform the gradation conversion based on the gradation conversion curve in said gradation conversion means after the high frequency component converted by said conversion means is added to the arbitrary image, or controls to add the high frequency component converted by said conversion means after the arbitrary image is subjected to the gradation conversion based

on the gradation conversion curve by said gradation conversion means.

2. (Currently Amended) An image processing apparatus for performing a dynamic range compression processing to an arbitrary image to add a high frequency component obtained based on the image, the image processing apparatus comprising:

gradation conversion means for performing gradation conversion on the image based on a gradation conversion curve;

storage means for storing information concerning the gradation conversion curve;

conversion means for converting the a magnitude of the an amplitude of said the added high frequency component based on information concerning the pixel value of said the arbitrary image and the information concerning the gradation conversion curve stored in said storage means; and

control means for controlling said gradation conversion means and said conversion means,

wherein said control means controls to perform the gradation conversion based on the gradation conversion curve in said gradation conversion means after the high frequency component converted by said conversion means is added to the arbitrary image, or controls to add the high frequency component converted by said conversion means after the arbitrary image is subjected to the gradation conversion based on the gradation conversion curve by said gradation conversion means.

3. (Currently Amended) An apparatus according to Claim 1, wherein ~~said~~ the arbitrary image includes any one of an original image, an image obtained by applying a gradation conversion processing to the original image, an image obtained by applying a smoothing processing to the original image, and an image obtained by applying both the smoothing processing and the gradation conversion processing to the original image.

4. (Original) An apparatus according to Claim 3, wherein said smoothing processing includes a processing which uses morphological filter calculation.

5. (Currently Amended) An apparatus according to Claim 1, wherein ~~said~~ the high frequency component includes a high frequency component obtained from any one of the original image of ~~said~~ the arbitrary image, and an image obtained by applying a gradation conversion processing to the original image of ~~said~~ the arbitrary image.

6. (Original) An apparatus according to Claim 1, further comprising gradation conversion means for performing a gradation conversion processing to the image to which the converted high frequency component obtained by said conversion means is added.

7. (Currently Amended) An image processing apparatus comprising:
gradation conversion means for converting the gradation of an original image based on a gradation conversion curve;

smoothing means for obtaining a smoothed image from the gradation-converted image obtained by said gradation conversion means;

high frequency component generation means for obtaining a difference between the smoothed image obtained by said smoothing means and the gradation-converted image obtained by said gradation conversion means as a high frequency component;

conversion means for converting the high frequency component obtained by said high frequency component generation means ~~dependent on the~~ based on a magnitude of the amplitude of the high frequency component and a value concerning an inclination of the gradation conversion curve; and

high frequency component addition means for adding the converted high frequency component obtained by said conversion means to the gradation-converted image obtained by said gradation conversion means.

8. (Currently Amended) An image processing apparatus comprising:

smoothing means for obtaining a smoothed image from an original image;

high frequency component generation means for obtaining a difference between the smoothed image obtained by said smoothing means and ~~said the~~ original image as a high frequency component;

~~conversion means for converting the high frequency component obtained by said high frequency component generation means dependent on the magnitude~~

~~of the amplitude of the high frequency component;~~

gradation conversion means for converting the gradation of ~~said the~~
original image based on a gradation conversion curve; and

conversion means for converting the high frequency component
obtained by said high frequency component generation means based on a magnitude of the
high frequency component and a value concerning an inclination of the gradation
conversion curve; and

high frequency component addition means for adding the converted
high frequency component obtained by said conversion means to the gradation-converted
image obtained by said gradation conversion means.

9. (Currently Amended) An image processing apparatus comprising:

smoothing means for obtaining a smoothed image from an original
image;

high frequency component generation means for obtaining a
difference between the smoothed image obtained by said smoothing means and ~~said the~~
original image as a high frequency component;

conversion means for ~~converting~~ monotonously increasing the high
frequency component obtained by said high frequency component generation means
~~dependent on the magnitude of the amplitude of the high frequency component in~~
proportion to increase the absolute value of the high frequency component, and converting
the high frequency component based on an upward-convex function;

gradation conversion means for converting the gradation of the smoothed image obtained by said smoothing means; and

high frequency component addition means for adding the converted high frequency component obtained by said conversion means to the gradation-converted smoothed image obtained by said gradation conversion means.

10. (Currently Amended) An image processing apparatus comprising:

smoothing means for obtaining a smoothed image from an original image;

high frequency component generation means for obtaining a difference between the smoothed image obtained by said smoothing means and ~~said~~ the original image as a high frequency component;

conversion means for converting the high frequency component obtained by said high frequency component generation means ~~dependent on the~~ based on a magnitude of the amplitude of the high frequency component and a value concerning an inclination of a gradation conversion curve;

high frequency component addition means for adding the converted high frequency component obtained by said conversion means to ~~said~~ the original image; and

gradation conversion means for converting the gradation of the image after the high frequency component addition obtained by said high frequency component addition means, based on the gradation conversion curve.

11. (Canceled)

12. (Currently Amended) An image processing apparatus comprising:

gradation conversion means for converting the gradation of an original image;

smoothing means for obtaining a smoothed image from the gradation-converted image obtained by said gradation conversion means;

high frequency component generation means for obtaining a difference between the smoothed image obtained by said smoothing means and the gradation-converted image obtained by said gradation conversion means as a high frequency component;

conversion means for converting the high frequency component obtained by said high frequency component generation means dependent on the a magnitude of a pixel value; and

high frequency component addition means for adding the converted high frequency component obtained by said conversion means to the gradation-converted image obtained by said gradation conversion means.

13. (Currently Amended) An image processing apparatus comprising:

smoothing means for obtaining a smoothed image from an original image;

high frequency component generation means for obtaining a difference between the smoothed image obtained by said smoothing means and ~~said the~~ original image as a high frequency component;

conversion means for converting the high frequency component obtained by said high frequency component generation means dependent on ~~the~~ a magnitude of a pixel value;

gradation conversion means for converting the gradation of ~~said the~~ original image; and

high frequency component addition means for adding the converted high frequency component obtained by said conversion means to the gradation-converted image obtained by said gradation conversion means.

14. (Currently Amended) An image processing apparatus comprising:

smoothing means for obtaining a smoothed image from an original image;

high frequency component generation means for obtaining a difference between the smoothed image obtained by said smoothing means and ~~said the~~ original image as a high frequency component;

conversion means for converting the high frequency component obtained by said high frequency component generation means dependent on ~~the~~ a magnitude of a pixel value;

gradation conversion means for converting the gradation of the

smoothed image obtained by said smoothing means; and

high frequency component addition means for adding the converted high frequency component obtained by said conversion means to the gradation-converted image obtained by said gradation conversion means.

15. (Currently Amended) An image processing apparatus comprising:

smoothing means for obtaining a smoothed image from an original image;

high frequency component generation means for obtaining a difference between the smoothed image obtained by said smoothing means and ~~said~~ the original image as a high frequency component;

conversion means for converting the high frequency component obtained by said high frequency component generation means dependent on ~~the~~ a magnitude of a pixel value;

high frequency component addition means for adding the converted high frequency component obtained by said conversion means to ~~said~~ the original image; and

gradation conversion means for converting the gradation of the image after the high frequency component addition obtained by said high frequency component addition means.

16. (Currently Amended) An apparatus according to Claim 7, wherein said

smoothing means obtains ~~said~~ the smoothed image by morphological filter calculation.

17. (Currently Amended) An image processing method for performing a dynamic range compression processing to an arbitrary image to add a high frequency component obtained based on the image, the image processing method comprising:

a converting step₁ of converting ~~the~~ a magnitude of ~~the~~ an amplitude of ~~said~~ the added high frequency component based on ~~the~~ a magnitude of the high frequency component.

18. (Currently Amended) An image processing method for performing a dynamic range compression processing to an arbitrary image to add a high frequency component obtained based on the image, the image processing method comprising:

a converting step₁ of converting ~~the~~ a magnitude of ~~the~~ an amplitude of ~~said~~ the added high frequency component based on the pixel value of ~~said~~ the arbitrary image.

19. (Currently Amended) A method according to Claim 17, wherein ~~said~~ the arbitrary image includes any one of an original image, an image obtained by applying a gradation conversion processing to the original image, an image obtained by applying a smoothing processing to the original image, and an image obtained by applying both the smoothing processing and the gradation conversion processing to the original image.

20. (Original) A method according to Claim 19, wherein said smoothing processing includes a processing which uses morphological filter calculation.

21. (Currently Amended) A method according to Claim 17, wherein ~~said~~ the high frequency component includes a high frequency component obtained from any one of the original image of ~~said~~ the arbitrary image, and an image obtained by applying a gradation conversion processing to the original image of ~~said~~ the arbitrary image.

22. (Currently Amended) A method according to Claim 17, further comprising a gradation converting step₂ of performing a gradation conversion processing to the image to which the converted high frequency component obtained by said converting step is added.

23. (Canceled)

24. (Currently Amended) An image processing method for performing a dynamic range compression processing to an arbitrary image ~~obtained by performing gradation conversion to an original image~~ to add the high frequency component of the ~~original image or the high frequency component of the image obtained by performing gradation conversion to the original image~~ obtained based on the arbitrary image, the image processing method comprising ~~the steps of:~~

a conversion step₁ of converting the a magnitude of the an amplitude

of ~~said added~~ the high frequency component based on ~~the~~ a magnitude of the high frequency component and a value concerning an inclination of a gradation conversion curve; and

a gradation conversion step, of performing gradation conversion to the image to which the high frequency component converted in said conversion step was added, based on the gradation conversion curve.

25. (Currently Amended) An image processing method for performing a dynamic range compression processing to an arbitrary image ~~obtained by performing gradation conversion to the smoothed image of an original image~~ to add the high frequency component ~~of the original image~~ obtained based on the arbitrary image, the said image processing method comprising ~~the steps of:~~

a conversion step, of converting the a magnitude of the an amplitude of said added the high frequency component based on ~~the magnitude of the high frequency component~~ a pixel value of the arbitrary image and a value concerning an inclination of a gradation conversion curve; and

a gradation conversion step, of performing gradation conversion to the image to which the high frequency component converted in said conversion step was added, based on the gradation conversion curve.

26. (Currently Amended) An image processing method for performing a dynamic range compression processing to an original image or ~~the~~ a smoothed image of the

original image to add the high frequency component of the original image and perform gradation conversion, ~~the~~ said image processing method comprising the steps of:

converting ~~the~~ a magnitude of ~~the~~ an amplitude of ~~said~~ the added high frequency component in accordance with ~~the~~ a magnitude of the high frequency component.

27. (Currently Amended) An image processing method for performing a dynamic range compression processing to an image obtained by performing gradation conversion to an original image to add the high frequency component of the original image or the high frequency component of the image obtained by performing the gradation conversion to the original image, ~~the~~ said image processing method comprising the steps step of:

converting ~~the~~ a magnitude of ~~the~~ an amplitude of ~~said~~ the added high frequency component in accordance with ~~the~~ a magnitude of a pixel value.

28. (Currently Amended) An image processing method for performing a dynamic range compression processing to an image obtained by performing gradation conversion to ~~the~~ a smoothed image of an original image to add ~~the~~ a high frequency component of the original image, ~~the~~ said image processing method comprising the steps step of:

converting ~~the~~ a magnitude of ~~the~~ an amplitude of ~~said~~ the added high frequency component in accordance with ~~the~~ a magnitude of a pixel value.

29. (Currently Amended) An image processing method for performing a dynamic range compression processing to an original image or ~~the~~ a smoothed image of the original image to add ~~the~~ a high frequency component of the original image and perform gradation conversion, ~~the~~ said image processing method comprising the ~~steps~~ step of:

converting ~~the~~ a magnitude of ~~the~~ an amplitude of ~~said~~ the added high frequency component in accordance with ~~the~~ a magnitude of a pixel value.

30. (Currently Amended) A memory medium for storing a computer-readable program of an image processing apparatus for performing a dynamic range compression processing to an arbitrary image to add a high frequency component obtained based on the image, the ~~computer~~ computer-readable program comprising the ~~steps~~ of:

a gradation conversion step, of performing gradation conversion to the image based on a gradation conversion curve;

a storage step, of storing information concerning the gradation conversion curve in a memory;

a conversion step, of converting ~~the~~ a magnitude of ~~the~~ an amplitude of ~~said-added~~ the high frequency component based on information concerning the magnitude of the high frequency component and the information concerning the gradation conversion curve; and

a control step, of controlling said gradation conversion step and said conversion step,

wherein said control step includes controlling to perform the

gradation conversion based on the gradation conversion curve in said gradation conversion means after the high frequency component converted in said conversion step is added to the arbitrary image, or controlling to add the high frequency component converted in said conversion step after the arbitrary image is subjected to the gradation conversion based on the gradation conversion curve in said gradation conversion step.

31. (New) A control method for an image processing apparatus for performing a dynamic range compression processing to an arbitrary image to add a high frequency component obtained based on the image, said method comprising:

a gradation conversion step, of performing gradation conversion to the image based on a gradation conversion curve;

a storage step, of storing information concerning the gradation conversion curve in a memory;

a conversion step, of converting a magnitude of an amplitude of the high frequency component based on information concerning the magnitude of the high frequency component and the information concerning the gradation conversion curve; and

a control step, of controlling said gradation conversion step and said conversion step,

wherein said control step ~~controls~~ including controlling to perform the gradation conversion based on the gradation conversion curve in said gradation conversion means after the high frequency component converted in said conversion step is added to the arbitrary image, or ~~controls~~ controlling to add the high frequency component

converted in said conversion step after the arbitrary image is subjected to the gradation conversion based on the gradation conversion curve in said gradation conversion step.

32. (New) An image processing method comprising:

a gradation conversion step, of converting a gradation of an original image based on a gradation conversion curve;

a high frequency component generation step, of obtaining a high frequency component from the image after the gradation conversion obtained in said gradation conversion step;

a conversion step, of converting the high frequency component obtained in said high frequency component generation step, based on information concerning a magnitude of the high frequency component and information concerning the gradation conversion curve; and

an image synthesis step, of obtaining a processed image from the high frequency component after the conversion obtained in said conversion step and the image after the gradation conversion obtained in said gradation conversion step.

33. (New) An image processing method for an image processing apparatus, comprising:

a high frequency component generation step, of obtaining a high frequency component from an original image;

a gradation conversion step, of converting a gradation of the original

image based on a gradation conversion curve;

a conversion step, of converting the high frequency component obtained in said high frequency component generation step, based on information concerning a magnitude of the high frequency component and information concerning the gradation conversion curve; and

an image synthesis step, of obtaining a processed image from the high frequency component after the conversion obtained in said conversion step and the image after the gradation conversion obtained in said gradation conversion step.

34. (New) An image processing method for an image processing apparatus, comprising:

a high frequency component generation step, of obtaining a high frequency component from an original image;

a conversion step, of converting the high frequency component obtained in said high frequency component generation step, based on information concerning a magnitude of the high frequency component and information concerning a gradation conversion curve;

an image synthesis step, of obtaining a processed image from the high frequency component after the conversion obtained in said conversion step and the original image; and

a gradation conversion step of converting a gradation of the image obtained in said image synthesis step, based on the gradation conversion curve.

35. (New) An image processing apparatus comprising:

gradation conversion means for converting a gradation of an original image based on a gradation conversion curve;

high frequency component generation means for obtaining a high frequency component from the image after the gradation conversion obtained by said gradation conversion means;

conversion means for converting the high frequency component obtained by said high frequency component generation means, based on information concerning a magnitude of the high frequency component and information concerning the gradation conversion curve; and

image synthesis means for obtaining a processed image from the high frequency component after the conversion obtained by said conversion means and the image after the gradation conversion obtained by said gradation conversion means.

36. (New) An image processing apparatus comprising:

high frequency component generation means for obtaining a high frequency component from an original image;

gradation conversion means for converting a gradation of the original image based on a gradation conversion curve;

conversion means for converting the high frequency component obtained by said high frequency component generation means, based on information concerning a magnitude of the high frequency component and information concerning the

gradation conversion curve; and

image synthesis means for obtaining a processed image from the high frequency component after the conversion obtained by said conversion means and the image after the gradation conversion obtained by said gradation conversion means.

37. (New) An image processing apparatus comprising:

high frequency component generation means for obtaining a high frequency component from an original image;

conversion means for converting the high frequency component obtained by said high frequency component generation means, based on information concerning a magnitude of the high frequency component and information concerning a gradation conversion curve;

image synthesis means for obtaining a processed image from the high frequency component after the conversion obtained by said conversion means and the original image; and

gradation conversion means for converting a gradation of the image obtained by said image synthesis means, based on the gradation conversion curve.

38. (New) An image processing method comprising:

a gradation conversion step, of converting a gradation of an original image based on a gradation conversion curve;

a high frequency component generation step, of obtaining a high

frequency component from the image after the gradation conversion obtained in said gradation conversion step;

a conversion step, of converting the high frequency component obtained in said high frequency component generation step, based on information concerning a pixel value of the original image and information concerning the gradation conversion curve; and

an image synthesis step, of obtaining a processed image from the high frequency component after the conversion obtained in said conversion step and the image after the gradation conversion obtained in said gradation conversion step.

39. (New) An image processing method for an image processing apparatus, comprising:

a high frequency component generation step, of obtaining a high frequency component from an original image;

a gradation conversion step, of converting a gradation of the original image based on a gradation conversion curve;

a conversion step, of converting the high frequency component obtained in said high frequency component generation step, based on information concerning a pixel value of the original image and information concerning the gradation conversion curve; and

an image synthesis step of obtaining a processed image from the high frequency component after the conversion obtained in said conversion step and the

image after the gradation conversion obtained in said gradation conversion step.

40. (New) An image processing method for an image processing apparatus, comprising:

a high frequency component generation step, of obtaining a high frequency component from an original image;

a conversion step, of converting the high frequency component obtained in said high frequency component generation step, based on information concerning a pixel value of the original image and information concerning a gradation conversion curve;

an image synthesis step, of obtaining a processed image from the high frequency component after the conversion obtained in said conversion step and the original image; and

a gradation conversion step, of converting a gradation of the image obtained in said image synthesis step, based on the gradation conversion curve.

41. (New) An image processing apparatus comprising:

gradation conversion means for converting a gradation of an original image based on a gradation conversion curve;

high frequency component generation means for obtaining a high frequency component from the image after the gradation conversion obtained by said gradation conversion means;

conversion means for converting the high frequency component obtained by said high frequency component generation means, based on information concerning a pixel value of the original image and information concerning the gradation conversion curve; and

image synthesis means for obtaining a processed image from the high frequency component after the conversion obtained by said conversion means and the image after the gradation conversion obtained by said gradation conversion means.

42. (New) An image processing apparatus comprising:

high frequency component generation means for obtaining a high frequency component from an original image;

gradation conversion means for converting a gradation of the original image based on a gradation conversion curve;

conversion means for converting the high frequency component obtained by said high frequency component generation means, based on information concerning a pixel value of the original image and information concerning the gradation conversion curve; and

image synthesis means for obtaining a processed image from the high frequency component after the conversion obtained by said conversion means and the image after the gradation conversion obtained by said gradation conversion means.

43. (New) An image processing apparatus comprising:

high frequency component generation means for obtaining a high frequency component from an original image;

conversion means for converting the high frequency component obtained by said high frequency component generation means, based on information concerning a pixel value of the original image and information concerning a gradation conversion curve;

image synthesis means for obtaining a processed image from the high frequency component after the conversion obtained by said conversion means and the original image; and

gradation conversion means for converting a gradation of the image obtained by said image synthesis means, based on the gradation conversion curve.